

What is science reading?

- Reading of scientific genres that include:
 - Textbooks
 - Lab Reports
 - Proposals for experiments
 - Experiments
 - Lay descriptions of processes on, findings, and implications of scientific knowledge



What are the characteristics of science texts?

- Dense vocabulary—technical terms and general academic vocabulary necessary to understand the technical terms
- Text, graphics (figures, tables, drawings, photographs), and symbols (e.g. in a formula) working together as alternate representations of information to build a full meaning of the concepts to be learned.
- Objective rather than personal tone—lack of agency.
- Genre dependent predictable structures



Example

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How are STRs used to make a DNA profile?

Each STR is composed of two to nine nucleotides. Each allele, of an STR contains a unique number of repeated copies of these nucleotides. For example, an STR might contain copies of three nucleotides AGA. An allele of this STR (allele 1) might contain one copy of AGA, another might have three (allele 2), and yet another (allele 3) might have five, as shown here:

Allele 2: ...AGA... Allele 2: ...AGAAGAAGA...

Analysis of several STR alleles can show how frequently a specific combination of these alleles is found in a population. Different populations may have different frequencies of these alleles. This analysis is done in a series of steps:

- DNA samples from a population are analyzed to establish which STR alleles are present in members of the population.
- The results can be analyzed to see how often specific combinations of alleles are present in a population; this result is called the population frequency (discussed in more detail in Chapter 14).
- The population frequencies for each STR allele are multiplied together to estimate the probability that anyone who carries this specific combination of alleles is a match to the sample being tested.

STR	Allele	Frequency in population	Combined frequency	
A	1	1 in 25		
8	2	1 in 100	A1 × B2 (1 in 25 × 1 in 100) = 1 in 2500	
C	3	1 in 320	A1 × B2 × C3 (1 in 25 × 1 in 100 × 1 in 320) = 1 in 800,000	
D	4	1 in 75	A1 × B2 × C3 × D4 (1 in 25 × 1 in 100 × 1 in 320 × 1 in 7 = 1 in 60 million	

The combined frequency shows that the more alleles that are analyzed, the rarer the combination becomes in the population. Later discussion will show how this applies to criminal cases.

Where do DNA samples come from?

DNA profiles can be prepared from very small DNA samples (thanks to PCR) obtained from many different sources, including single hairs, licked envelope flaps, toothbrushes, cigarette butts, and dried saliva on the back of a postage stamp.

Evidence from crimes including murder, rape, breakins, and hit and run accidents can be used. Profiles can also be obtained from very old samples of DNA, increasing its usefulness in legal cases. In fact, DNA profiles have been prepared from mummies more than 2400 years

8.2 Essentials

- Three types of DNA variations are used in DNA profiling: minisatellites, short tandem repeats (STRs), and single nucleotide polymorphisms (SNPs).
- Two common methods used in DNA forensics are restriction fragment length polymorphism (RFLP) analysis and the polymerase chain reaction (PCR).
- DNA samples for these tests can come from any number of sources, including cheek swabs, semen, saliva, and blood.
- Each of these tests can be used to analyze DNA and then make a comparison with other samples.



Example

If someone with a genetic disorder is born into a family with no history of that disorder, the question is whether the cause is genetic or nongenetic. For example, a woman who drinks alcohol while pregnant may have a child with facial defects, growth problems, and nervous system abnormalities. This condition could be fetal alcohol syndrome, a nongenetic disorder. However, these symptoms are similar to those seen in several genetic disorders, including Williams syndrome and Noonan syndrome. To determine whether a condition is caused by genetic or nongenetic factors,

a family history should be taken, a pedigree constructed, and a genetic test done, if available.

If pedigree analysis shows that a genetic disorder has appeared in a family with no history of the condition, it is often assumed that a mutation has occurred. If, however, an autosomal recessive trait suddenly appears in a family, it is usually very difficult to identify when the mutation first occurred. Recessive alleles can be carried through several generations before becoming visible. Mutations leading to new alleles produce the genetic diversity we see in those around us. This includes disorders such as sickle cell anemia, the condition that Marcia Johnson is so worried about, as well as other traits that make up our phenotype.

5.5 Essentials

- Genes can be changed by mutations, which change the function of the proteins they produce.
- A gene mutation can cause one amino acid of a protein to be substituted for another amino acid.



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Number of amino acids, in the beta globin molecule.

1

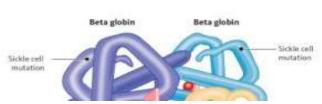
Number of mistakes in a gene that can cause sickle cell anemia. folds into a three-dimensional shape that is determined by its amino acid sequence. This three-dimensional shape, ultimately determined by the order of bases in DNA, can alter a protein's function (* Figure 5.4).

Some mutations alter the threedimensional shape of a protein, causing a genetic disorder. For example, cystic fibrosis and a genetic form of Alzheimer disease are associated with defects in folding. In these disorders, defective folding prevents the protein from functioning normally. In other disorders, such as mad cow disease and its human equiva-

lent, Creutzfeldt-Jakob disease (CJD), defective protein folding can cause other proteins in the body to malfunction, producing an abnormal phenotype.

Which protein is altered in sickle cell anemia?

Remember from Chapter 4 that sickle cell anemia is inherited as an autosomal recessive trait. Affected individuals can have a wide range of symptoms, including weakness, abdominal pain, kidney failure, and heart failure (*Figure 5.5), that can lead to early death if left untreated. This painful and disabling condition (*Figure 5.6) is caused by a mutation in the gene that encodes hemoglobin, the oxygen-carrying protein in the blood.





Purposes for reading science texts

- To be informed
- To learn information
- To make decisions:
 - Should I do something to reduce greenhouse gases?
 - Should I vote for politicians who are for the use of embryos for genetic testing?
 - What should I eat/not eat?
 - What will be the effect of mixing these two household chemicals?



Why is reading in science important?

- Science teachers often take away science text because students have difficulty reading it, but....
 - Students don't get any better at reading science text if they don't do it
 - Scientists spend most of their time reading and writing
 - Reading is an important way to learn science information
 - Can ameliorate misconceptions
 - Can provide a necessary level of detail that can be studied



Why is reading in science important?

- Understanding science is important to one's informed decision-making
- Reducing salt in teen diet could have big impact on future health
- Published: Monday, November 15, 2010 16:03 in <u>Health & Medicine</u>
- Cutting back on salt in teenagers' diets by as little as one-half teaspoon, or three grams, a day, could reduce the number of young adults with high blood pressure by 44 to 63 percent, according to new research presented Sunday, Nov. 14 at the American Heart Association's Scientific Sessions 2010 meeting in Chicago. The findings indicate that the food industry and those who regulate it could substantially improve the nation's health through even small reductions in the amount of salt in processed foods, which account for the majority of salt consumed in this country.
- "The U.S. diet is already high in salt, and adolescents consume more salt more than 9 grams (3,800 milligrams of sodium) than any other age group," said presenter Kirsten Bibbins-Domingo, PhD, MD, UCSF associate professor of medicine and epidemiology. The American Heart Association recommends no more than 1,500 milligrams of sodium a day for most Americans.
- The research team from UCSF and Columbia University Medical Center examined the potential impact of population-wide reductions in dietary salt on cardiovascular risk in American adolescents. Using data from the National Health and Nutrition Examination Survey 1999-2008 to determine the distribution of systolic blood pressure among adolescents and adults, the team performed an analysis using the Coronary Heart Disease Policy Model. The model, a computer simulation of heart disease among U.S. adults, has helped researchers project potential benefits of public health interventions.



Why is reading science important?

- It is a major part of the new Common Core Standards—Literacy in Science and Technical Subjects
- It is a part of college and career readiness
 - All college students complete science coursework—that is reading intensive (and with no student support) so that students must become independent readers of scientific text
 - Many careers are in scientific fields or require some knowledge of science farming, truck-driving, building



Why is reading in science important

- Reading is required for the science portion of the ACT!
- The ACT measures:
 - Interpretation
 - Analysis
 - Evaluation
 - Reasoning
 - Problem solving
- The test assumes student:
 - Has taken earth/physical science and biology
 - Will take 3 or more courses in science



More on the ACT



- What kind of information is featured?
 - data representation (graphs, tables, and other schematic forms)
 - research summaries (descriptions of one or more related experiments)
 - conflicting viewpoints (expressions of several related hypotheses or views that are inconsistent with one another)
- What do the questions require?
 - Understanding the concepts
 - Critical reasoning
 - Generalization, prediction, drawing conclusions

Type of ACT Question relating to science:

Passage I

- Unmanned spacecraft taking images of Jupiter's moon Europa have found its surface to be very smooth with few meteorite craters. Europa's surface ice shows evidence of being continually resmoothed and reshaped. Cracks, dark bands, and *pressure ridges* (created when water or slush is squeezed up between 2 slabs of ice) are commonly seen in images of the surface. Two scientists express their views as to whether the presence of a deep ocean beneath the surface is responsible for Europa's surface features.
- Scientist 1:A deep ocean of liquid water exists on Europa. Jupiter's gravitational field produces tides within Europa that can cause heating of the subsurface to a point where liquid water can exist. The numerous cracks and dark bands in the surface ice closely resemble the appearance of thawing ice covering the polar oceans on Earth. Only a substantial amount of circulating liquid water can crack and rotate such large slabs of ice. The few meteorite craters that exist are shallow and have been smoothed by liquid water that oozed up into the crater from the subsurface and then quickly froze. Jupiter's magnetic field, sweeping past Europa, would interact with the salty, deep ocean and produce a second magnetic field around Europa. The spacecraft has found evidence of this second magnetic field.
- Scientist 2: No deep, liquid water ocean exists on Europa. The heat generated by gravitational tides is quickly lost to space because of Europa's small size, as shown by its very low surface temperature (-160°C). Many of the features on Europa's surface resemble features created by flowing glaciers on Earth. Large amounts of liquid water are not required for the creation of these features. If a thin layer of ice below the surface is much warmer than the surface ice, it may be able to flow and cause cracking and movement of the surface ice. Few meteorite craters are observed because of Europa's very thin atmosphere; surface ice continually sublimes (changes from solid to gas) into this atmosphere, quickly eroding and removing any craters that may have formed.



1. Which of the following best describes how the 2 scientists explain how craters are removed from Europa's surface?

Scientist 1 Scientist 2

A. Sublimation Filled in by water

B. Filled in by water Sublimation

C. Worn smooth by wind Sublimation

D. Worn smooth by wind Filled in by water

2. According to the information provided, which of the following descriptions of Europa would be accepted by both scientists?

A. Europa has a larger diameter than does Jupiter.

B. Europa has a surface made of rocky material.

C. Europa has a surface temperature of 20°C.

D. Europa is completely covered by a layer of ice.



5. Scientist 2 explains that ice sublimes to water vapor and enters Europa's atmosphere. If ultraviolet light then broke those water vapor molecules apart, which of the following gases would one most likely expect to find in Europa's atmosphere as a result of this process?



- A. Nitrogen
- B. Methane
- C. Chlorine
- D. Oxygen

The Lessons



- How does science work in the environment?
- What are scientists "talking" about right now?
- What are the responsibilities of the individual and/or society in regards to the environment?
- Modeling
- Guided Practice
- Independent Practice
- Feedback



Vocabulary

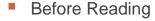


- fossil fuels
- greenhouse gases
- emissions
- intensity
- consumer
- stakeholders
- global warming
- climate change

Environmental indicators

- sea level
- indicator
- clean energy
- reduction
- atmosphere
- initiatives

Examples of Strategies



- Quickwrites
- Vocabulary chains
- Setting purposes for reading
- Surveying and predicting

During Reading

- Returning to predictions
- Marginal notations
- Burkes Summary Notes Organizer
- Structural Analysis
- Concept Mapping

After Reading

- Summarizing
- Socratic Discussion
- Writing Reflectively
- Writing an argument



Writing Activities



- Constructing an outline or map of your thoughts
- Formulating a thesis or controlling idea
- Composing a draft
- Revising
- Editing
- Reflecting
- Sharing



What will teachers need to do to teach the unit?

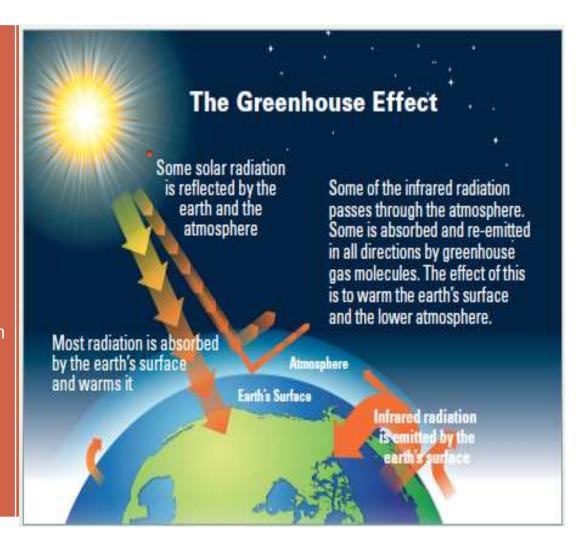
- Decide how to introduce and frame/reframe the essential questions as they relates to each of the readings
- Help students to write a culminating essay that answers the questions
- Decide before teaching how the strategies can be used to help students understand the science texts, especially in relation to the essential questions
- Choose strategies that make sense for the discipline of science
- The teacher provides the glue!



Example: The Greenhouse Effect

Background: The Greenhouse Effect

The Earth receives energy from the sun, then radiates much of this energy back toward space. However, certain gases in the atmosphere, called greenhouse gases, absorb some of the outgoing energy and trap it in the atmosphere. This "greenhouse effect" occurs naturally, but human activities have substantially increased the amount of greenhouse gases atmosphere in the atmosphere, causing the Earth to trap more heat. This in turn is changing the Earth's climate.



What should a teacher consider?

- What does this piece say in regards to the essential questions?
- What stylistic features are in this text that your students should know?
- How is this text structured?
- Which before, during, and after activities make most sense for your students?
- What does this piece say about the author? Why did he/she write it? What does he/she want you to think about the greenhouse effect? How will you get your students to pay attention to these issues?



Before Reading: Quickwrites



- What do you know about climate change?
- What does going green mean to you?
- These questions help help students access background knowledge



Before Reading: Surveying

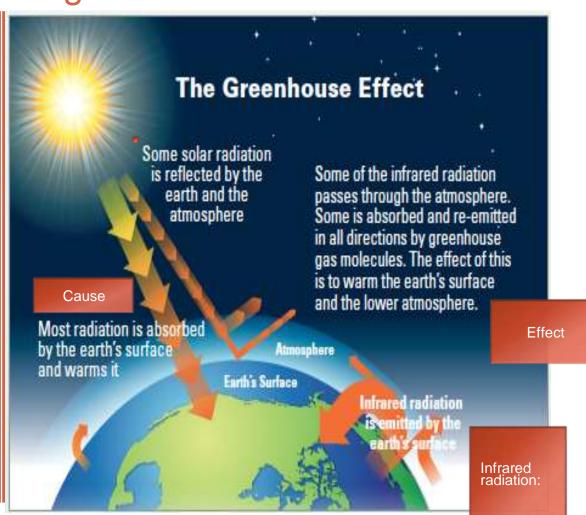
- What is the purpose/focus for reading?
 - To understand the process of global warming
- What do you notice? What text features do you notice?
 - Combination of graphics and text
 - Arrows show the cause/effect nature of the processes
- The EPA is a federal government agency. How does that effect the information in the text?
- The answer to these and other questions will support students reading of the text.



During Reading: Marginal Notes

Background: The Greenhouse Effect

The Earth receives energy from the sun, then radiates much of this energy back toward space. However, certain gases in the atmosphere, called greenhouse gases, absorb some of the outgoing energy and trap it in the atmosphere. This "greenhouse effect" occurs naturally, but human.activities.have.substantially increased the amount of greenhouse gases in the atmosphere, causing the Earth to trap more heat. This in turn is changing the Earth's climate.



Linear Array-Vocabulary chain

Concept: Climate Change



Too hot for life

Icecap melts More violent storms

More

Ice— Less

Water

Too cold for life

During and After: Summary Notes



Summary Not		
Name	Osto	
Topic	Class/Period	╗
REFORE 1. Determine year jumpane. 2. Provise the docustrent. 3. Propium to take revise. DURING 4. Take roots to help you arriver these questions: * Who is non-deaff * What events, ideas, or people does the author emphasize? * What are the causes? 5. Instablish criteria to decremine when it important remough in include in the surrosary. 6. Isolated influentiation as you read to determine of a meets your criteria. * ATTER 7. Wire your summary, which should: * Indeatly the title, author, and imput in the first sentence. * state the most alies as the sentence is attention to the first sentence. * tate the most alies as the sentence. * tate the most alies as the sentence. * be also tree than the sentence that states the mather's most when the states that states the author's most when.		

After reading



- How does science work in the environment?
- What are scientists "talking" about right now?
- What are the responsibilities of the individual and/or society in regards to the environment?



Other Suggestions:



- A younger boy or girl
- A scientist
- A general lay audience
- Have students write in different genres and for different purposes
 - A lab report
 - A description of a process
 - A newspaper article



Remember the purpose

- To help students think deeply about science content
 - THANKS!!!
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